WHAT IS CLAIMED IS:

[c01] 1. A superconducting machine comprising:

a superconductive device;

a vacuum enclosure containing and thermally insulating said superconductive device;

a cold-trap configured to condense gases generated within said vacuum enclosure;

a coolant circulation system adapted to force flow of a cryogen to and from said superconductive device and said cold-trap; and

a cryogenic cooling system configured to cool the cryogen in said coolant circulation system upstream of said superconductive device.

[c02] 2. The superconducting machine of Claim 1, wherein said coolant circulation system comprises:

a primary cooling line configured to cool said superconducting device, and

a secondary cooling line configured to cool said cold-trap.

[c03] 3. The superconducting machine of Claim 2, wherein said coolant circulation system further comprises a flow control valve configured to control and apportion the flow of the cryogen between said primary and secondary cooling lines.

[c04] 4. The superconducting machine of Claim 2, wherein an inlet temperature of the cryogen in said primary cooling line is below an operating temperature of said

superconductive device, and wherein an exit temperature of the cryogen in said primary cooling line is about the operating temperature of said superconductive device.

[c05] 5. The superconducting machine of Claim 4, wherein the inlet temperature in said primary cooling line is at least about ten degrees Kelvin (10° K) below the exit temperature in said primary cooling line.

[c06] 6. The superconducting machine of Claim 4, wherein the inlet temperature in said primary cooling line is at least about twenty degrees Kelvin (20° K) below the exit temperature in said primary cooling line.

[c07] 7. The superconducting machine of Claim 4, wherein an inlet temperature of said secondary cooling line is below about the triple point for Hydrogen.

[c08] 8. The superconducting machine of Claim 7, wherein an exit temperature of the cryogen in said secondary cooling line is below about the triple point for Hydrogen.

[c09] 9. The superconducting machine of Claim 1, wherein said superconducting device comprises a superconducting magnet.

[c10] 10. The superconducting machine of Claim 1, wherein said superconducting device comprises a superconducting rotor assembly.

[c11] 11. A superconducting machine comprising:

a superconductive device;

a vacuum enclosure containing and thermally insulating said superconductive device;

a cold-trap configured to condense gases generated within said vacuum enclosure;

a primary coolant circulation system adapted to force flow of a primary cryogen to and from said superconductive device;

a primary cryogenic cooling system configured to cool the primary cryogen in said primary coolant circulation system upstream of said superconductive device;

a secondary coolant circulation system adapted to force flow of a secondary cryogen to and from said cold-trap; and

a secondary cryogenic cooling system configured to cool the secondary cryogen in said secondary coolant circulation system upstream of said cold-trap.

[c12] 12. The superconducting machine of Claim 11, wherein said primary coolant circulation system comprises a primary cooling line configured to cool said superconducting device, and wherein said secondary coolant circulation system comprises a secondary cooling line configured to cool said cold-trap.

[c13] 13. The superconducting machine of Claim 12, wherein an inlet temperature of said secondary cooling line is below about the triple point for Hydrogen.

[c14] 14. The superconducting machine of Claim 11, further comprising a rotor core, wherein said superconductive device comprises at least one superconducting coil extending around said rotor core.

[c15] 15. The superconducting machine of Claim 14, wherein said superconducting coil comprises a high-temperature superconducting coil.

[c16] 16. A superconducting rotor comprising:

a rotor core;

at least one superconducting coil extending around said rotor core;

a vacuum enclosure containing and thermally insulating said superconductive coil;

a cold-trap configured to condense gases generated within said vacuum enclosure;

a coolant circulation system adapted to force flow of a cryogen to and from said superconductive coil and said cold-trap; and

a cryogenic cooling system configured to cool the cryogen in said coolant circulation system upstream of said superconductive coil.

[c17] 17. The superconducting rotor of Claim 16, wherein said coolant circulation system comprises:

a primary cooling line configured to cool said superconducting coil, and

a secondary cooling line configured to cool said cold-trap.

[c18] 18. The superconducting rotor of Claim 17, wherein said coolant circulation system further comprises a flow control valve configured to control and apportion the flow of the cryogen between said primary and secondary cooling lines.

[c19] 19. The superconducting rotor of Claim 17, wherein said superconducting coil comprises a high-temperature superconducting coil.

[c20] 20. The superconducting rotor of Claim 19, wherein an inlet temperature of said secondary cooling line is below about the triple point for Hydrogen.

[c21] 21. A vacuum retention method for a high-temperature superconductive (HTS) device, said method comprising:

applying vacuum to the HTS device to thermally insulate the HTS device;

condensing gases generated around the HTS device using a cold-trap;

flowing a cryogen to and from the HTS device; and

flowing the cryogen to and from the cold-trap.

[c22] 22. The method of Claim 21, further comprising:

cooling the cryogen upstream of the HTS device; and

controlling the flow of the cryogen to the HTS device and the cold-trap.

[c23] 23. The method of Claim 22, further comprising trapping the condensed gases using the cold-trap.

[c24] 24. The method of Claim 21, wherein an inlet temperature of the cryogen flowing to the HTS device is below an operating temperature of the HTS device, and wherein an exit temperature of the cryogen flowing from the HTS device is about the operating temperature of the HTS device.

[c25] 25. The method of Claim 21, wherein an inlet temperature of the cryogen flowing to the cold-trap is below about the triple point for Hydrogen.

[c26] 26. The method of Claim 25, wherein an exit temperature of the cryogen flowing from the cold-trap is below about the triple point for Hydrogen.